Exhibit A

TO JOINT CLAIM CONSTRUCTION AND PRE-HEARING STATEMENT

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ASETEK DANMARK A/S

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

ASETEK DANMARK A/S, Plaintiff and Counterdefendant, v. COOLIT SYSTEMS, INC., Defendant and Counterclaimant.	CASE NO. 3:19-cv-00410-EMC **DECLARATION OF DR. DONALD E. TILTON IN SUPPORT OF ASETEK DANMARK A/S'S OPENING CLAIM CONSTRUCTION BRIEF**

I, Donald E. Tilton, declare as follows:

I. INTRODUCTION

1. I have been retained as an expert in thermal management of electronic and mechanical devices, particularly computer liquid cooling, by Finnegan, Henderson, Farabow, Garrett & Dunner, LLP for Asetek Danmark A/S in *Asetek Danmark A/S v. CoolIT Systems, Inc.* before the Northern District of California to opine on matters related to U.S. Patent Nos. 8,240,362; 8,245,764; 9,733,681; 10,078,354; 10,078,355; 8,746,330; 9,603,284; 9,057,567; and 10,274,266 (collectively the "patents-in-suit").

2. In forming my opinion in this Declaration. I have considered the patents-in-suit, their respective prosecution histories, the parties' proposed constructions of the disputed terms, and the parties' extrinsic evidence to support their respective proposed constructions, such as the dictionary definitions.

3. I am being compensated at the rate of $350 per hour for my work on this case. My compensation does not depend on the outcome of this litigation.

II. QUALIFICATIONS AND EXPERIENCE

4. I am a Mechanical Engineer. I have a B.S. in Mechanical Engineering from Washington State University, Pullman, WA. I also have an M.S. and a Ph.D. in Mechanical Engineering from the University of Kentucky, Lexington, KY.

5. My academic background in mechanical engineering had a specific focus in heat transfer, fluid flow, and thermodynamics. My master's thesis was in heat pipe cooling, and my doctoral thesis was in spray cooling technology, which is a liquid cooling system for electronic devices.

6. I am an experienced innovator and inventor with 25 issued patents, and many pending applications, spanning the fields of energy efficiency, renewable energy, thermal management systems, heat transfer, and fluid flow.

7. I founded Isothermal Systems Research, Inc. (sold to Parker Aerospace) in 1988 while attending graduate school at the University of Kentucky. I worked at Isothermal Systems Research from 1988 to 2008, and during that time I developed and deployed critical liquid cooling

technologies for aerospace, defense electronic systems, and high-end intelligence applications for the CIA, NSA, and other intelligence agencies.

8. While at Isothermal Systems Research, I had experience with developing desktop liquid cooling systems for companies such as Intel, Hewlett-Packard, Sun Microsystems, and Cray Research. I also had experience developing a rack-mounted server cooling product line called the M-Series. These M-Series server cooling systems were deployed in test installations with Dell, IBM, Hewlett Packard and other rack-mount servers. I worked on the development of liquid cooling systems continuously from 1996 to 2008.

9. I am an experienced entrepreneur and executive leader with 30 years of experience founding, growing and leading technology companies. I am currently employed by Redhorse Corporation, where I serve as the acting Installation Energy Manager at Andersen Air Force Base in Guam.

10. Attached as Exhibit A to this report is a copy of my CV, which provides a detailed listing of my publications and patents, as well as my education and experience. I have offered expert testimony in three other litigations (*Asia Vital Components Co., Ltd., v. Asetek Danmark A/S*, N.D. Cal., No. 3:16-cv-07160-JST, *Asetek Holdings Inc., et al. v. CoolIT Systems, Inc.*, N. D. Cal., No. 3:12-cv-04498-EMC, and *Asetek Danmark A/S v. CMI USA, Inc.*, N. D. Cal., No. 3:13-cv-00457-JST) in the past 5 years, including expert testimony during the jury trial of the latter case.

11. My opinions below are based on my education, experience, and knowledge in mechanical engineering, thermal management, and fluid mechanics, and my review of the documents cited above.

III. THE ASETEK PATENTS

12. Computers (and particularly their central processing units, or "CPUs") generate heat during operation, and as CPU performance increases, so does heat generation. The performance of a computer CPU chip is proportional to the density of the circuits and the clock speed. The greater the circuit density and clock speed, the greater the performance of the CPU. As performance increases, so does the amount of heat generated by the CPU, and also the need for efficient and effective

dissipation of the heat generated by the CPU. This is true for both personal computers (desktops, laptops, netbooks, etc.) and computer servers/data centers.

13. Various air cooling and liquid cooling methods exist to manage heat in a computer system. While air cooling systems are cheaper and easier to install, air cooling has a fundamental limit in heat density, and this limit is surpassed in many high-end applications, often necessitating a shift towards liquid cooling systems. Liquid cooling systems are more efficient at heat removal than air cooling systems. Prior art liquid cooling systems, however, were bulky and posed significant risk of leakage from having several components (such as a heat exchanger, a liquid reservoir, a pump, and a heat radiator) coupled together using tubes, as shown in Prior Art Figure 3 of the Asetek patents (depicted below).

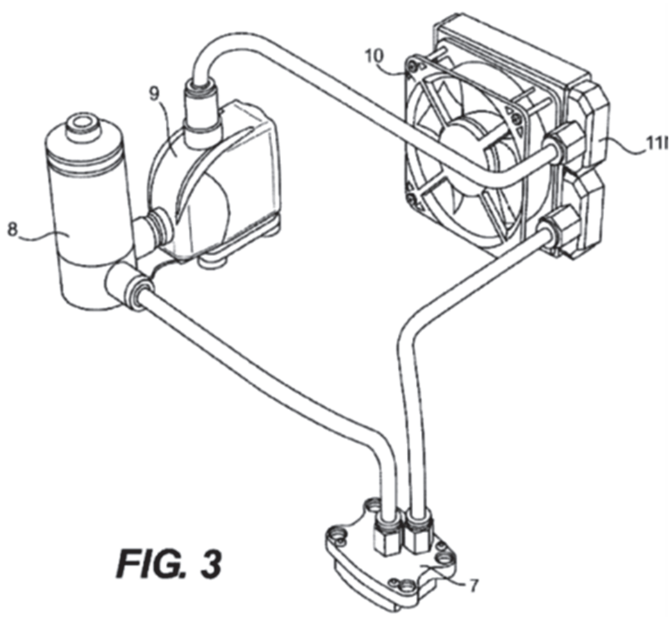


FIG. 3

14. The Asetek Patents (U.S. Patent Nos. 8,240,362; 8,245,764; 9,733,681; 10,078,354; and 10,078,355) disclose many technological advances in the art of computer liquid cooling. Among other things, Asetek's patented technology is a significant advancement from the modular approach of the prior art liquid cooling devices. Identical Figure 15 of all Asetek patents, and Figures 17 and 20 of Asetek's '764, '355, and '681 patents (Figures 15 and 20 depicted below), represent embodiments of the claimed invention. As evident from the patent claims and the figures, Asetek's claimed invention has, among other features, a pump unit that combines a pump, a dual-chambered

reservoir, and a heat exchanging interface (i.e., a cold plate) into a single component. The reservoir in Asetek's patented design is divided into two chambers (referred to as the "upper" and "lower" chambers in the '362 patent, and the "pump chamber" and "thermal exchange chamber" in the '764 patent). The chambers are vertically spaced apart and are fluidly coupled together to allow for heat dissipation from the CPU via the "heat exchanging interface," i.e., the boundary wall of the lower chamber/thermal exchange chamber which is placed in thermal contact with the CPU. This novel and innovative configuration, among other features of the patented inventions, enables separate and independent optimization of the pumping function in the upper chamber/pump chamber and the heat transfer function in the lower chamber/thermal exchange chamber.

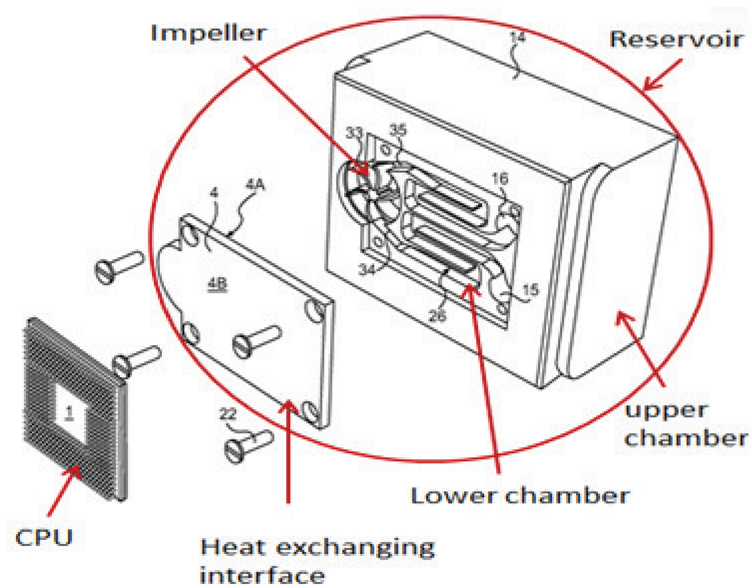


Figure 15

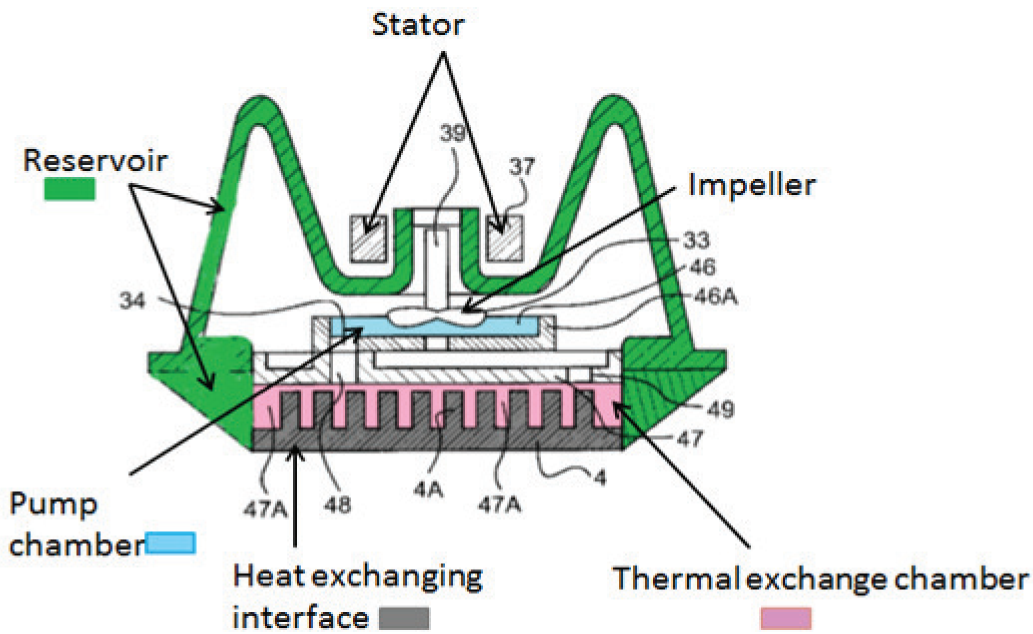


Figure 20

15. In addition to improved efficiency and compactness, Asetek's patented designs have greatly reduced and/or eliminated the risk of coolant leakage and have enabled pre-filled (factory assembled) liquid cooling products that are easy to install by users. The novel and innovative concepts disclosed in the Asetek Patents have also made manufacturing of liquid cooling products simpler and less costly.

IV. COOLIT PATENTS

16. The CoolIT patents (U.S. Patent Nos. 8,746,330; 9,603,284; 9,057,567; and 10,274,266) describe a fluid heat exchanger for liquid cooling of electronic devices, e.g., a computer system. In terms of the prior art Figure 3 of the Asetek patents, illustrated above, CoolIT's alleged invention is essentially directed to heat exchanger 7 (in Figure 3 of the Asetek patents), which is connected in a closed loop to a prior art liquid reservoir, a prior art pump, and a prior art heat radiator. In two of CoolIT's later patents—the '567 and the '266 patents—CoolIT additionally describes how its fluid heat exchanger can be integrated with a pump. Figure 1 of the '567 and the '266 patents (depicted below) describes how CoolIT's heat exchanger 11 can be connected via fluid

conduits to a pump 16 to form a fluid circuit 10. Figure 7 of the ’567 and the ’266 patents further illustrates one example for connecting several elements of fluid circuit 10 into a subassembly 300. In particular, Figure 7 of the ’567 and the ’266 patents illustrates how subassembly 300 combines a pump 310, a heat exchanger 320, and a housing 330 having integrated fluid conduits. *See* ’266 patent, 12:58-13:2; ’567 patent, 12:35-50.

CoolIT’s purported invention

(Fluid Heat Exchanger 11)

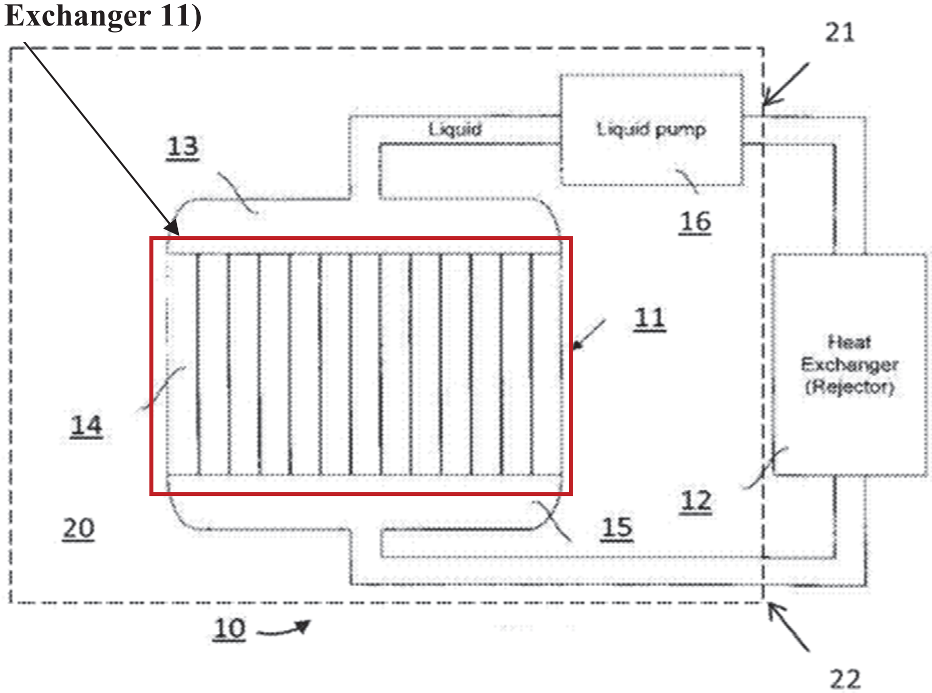
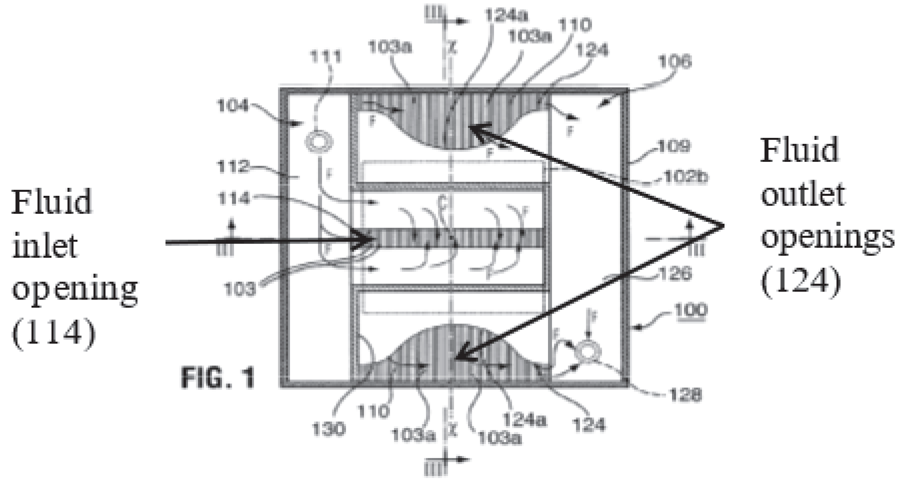


FIG. 1

17. The CoolIT patents describe a very specific structure/arrangement for a fluid heat exchanger, which includes a heat spreader plate (cold plate) that includes a plurality of parallel microchannels. A planar, rigid plate (or a complaint member 334 disclosed in the ’567 and the ’266 patents) is placed over the top of the microchannels to close off the channels at the top to form enclosed flow passages. The heat spreader plate is intended to be positioned in thermal communication with a heat source.



’330 patent, FIG. 1

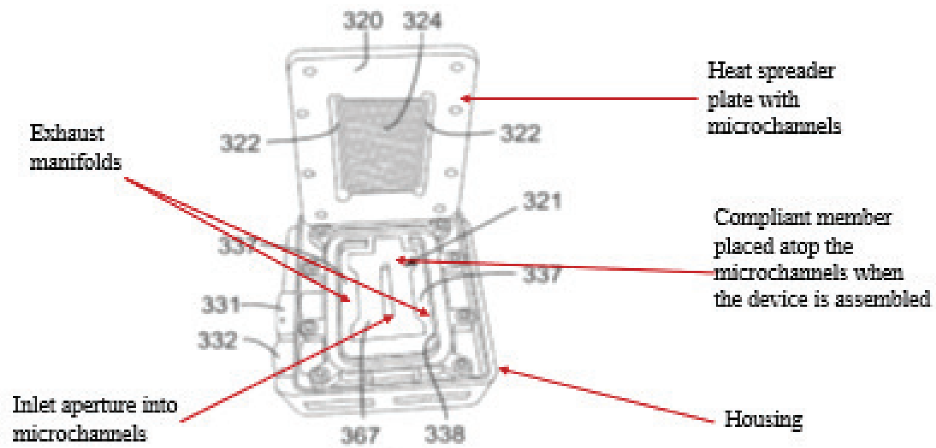


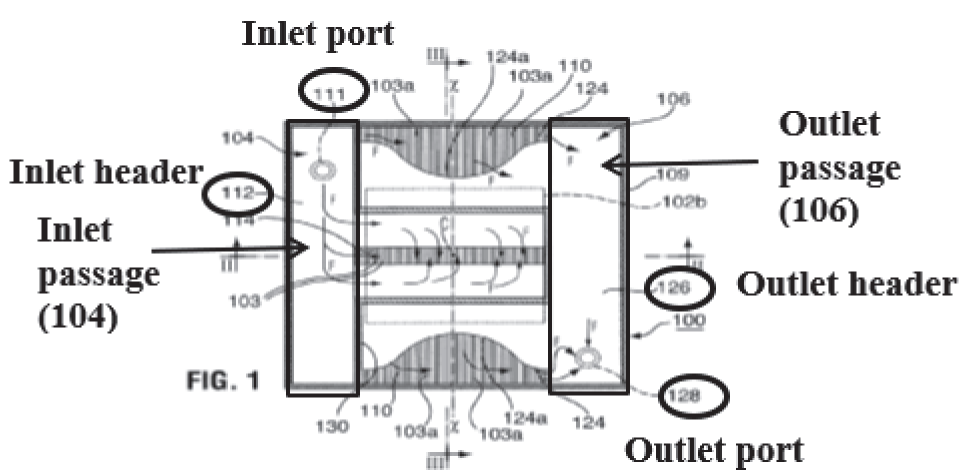
FIG. 11

’567 patent, FIG. 11

18. The plate (or compliant member) has cut-outs that form inlet and outlet openings. For example, see Figure 1 of the ’330 and the ’284 patent and Figure 11 of the ’567 and ’266 patents, both depicted above. In particular, the CoolIT patents describe an elongate opening that runs transverse to the length of the microchannels. The elongate opening defines a coolant inlet for the microchannels on the heat spreader plate. The plate (or compliant member) is positioned on the microchannels so that the elongate opening sits approximately midway along the length of the microchannels, as shown in Figures 1, 4, and 5 of the ’330 and ’284 patents, and Figures 2, 5, 6, and

11 of the ’567 and ’266 patents. This creates a split-flow arrangement in which coolant enters the microchannels at their mid-point, splits into two sub-flows and proceeds outwardly towards a pair of outlets provided at opposite ends of the microchannels. The plate (or compliant member) further includes two contoured openings/cut-outs at opposite ends of the plate towards the ends of the microchannels, as further shown in Figures 1, 4, and 5 of the ’330 and ’284 patents, and Figures 2, 5, 6, and 11 of ’567 and ’266 patents.

19. A housing having a top cap and sidewalls is placed over both the heat spreader plate and plate (or compliant member) to form the heat exchanger, as shown in FIGS. 2, 3, and 5 of the ’330 and ’284 patents, and Figures 3, 4, 6, 7, and 11 of ’567 and ’266 patents. The housing defines the coolant inlet and outlet passages, including an inlet header/inlet manifold and an outlet header/exhaust manifold, respectively. The housing also includes inlet and outlet ports that lead to and from the inlet and outlet headers/manifolds, respectively. A seal extends between the plate and the top of the housing to prevent short circuiting of coolant from the inlet passage to the outlet passage.



’330 patent, FIG. 1

V. LEVEL OF SKILL IN THE ART

20. In my opinion, a person of ordinary skill in the field of computer liquid cooling at the time of the inventions claimed in the Asetek patents and the CoolIT patents was someone who would

have completed college level course work in thermodynamics, fluid mechanics, and heat transfer, and would have two or more years of experience in designing liquid cooling systems for computers, or very similar technology, or one with a more advanced degree in the above fields may have had less practical experience.

21. I believe that I have the relevant experience and understanding of one of ordinary skill in this field.

VI. TERMS OF THE ASETEK PATENTS

A. "heat exchange/exchanging interface"

22. It is my understanding that the parties agree that the "heat exchange/exchanging interface" in the Asetek patents is a bottom boundary wall of the lower chamber/thermal exchange chamber. The specification and drawings of the Asetek patents support this interpretation of the "heat exchange/exchanging interface." One of ordinary skill in the art would also have understood that the "heat exchange/exchanging interface" is placed in thermal contact with a heat-generating component to transfer heat from the component to a cooling liquid flowing through the lower chamber/thermal exchange chamber.

23. I do not agree with CoolIT's proposed construction that adds the phrase "a separate heat-conducting plate" to the beginning of its construction ("<u>a separate heat-conducting plate</u> forming a bottom boundary wall for the lower chamber or the thermal exchange chamber"). It is unclear what the "heat-conducting plate" is separate from in CoolIT's construction. When the pump unit is assembled, the "heat exchange/exchanging interface" becomes part of the "reservoir" and serves as the bottom boundary wall of the lower chamber/thermal exchange chamber of the "reservoir." There is no separate or additional heat-conducting plate between the "reservoir" and the heat-generating component.

24. To the extent CoolIT wants to use its proposed construction to distinguish Asetek's patent claims from the embodiment depicted in Figure 9 of the Asetek patents (and associated text), CoolIT's reasoning for doing so is meritless. In the embodiment depicted in Figure 9, the top surface of the heat-generating component is in direct contact with the cooling liquid in the "reservoir," such that there is no "heat exchange/exchanging interface" in that embodiment. In contrast, the asserted

claims of the Asetek patents specifically recite a "heat exchange/exchanging interface" and do not claim the embodiment in Figure 9. For all these reasons, CoolIT's adding of the words "a separate heat-conducting plate" to the beginning of its construction is redundant and unnecessarily confusing. In contrast, Asetek's proposed construction — "bottom boundary wall of the lower chamber/thermal exchange chamber configured to thermally contact a heat-generating component" —accurately captures the meaning of the term "heat exchange/exchanging interface."

B. "removably coupled"

25. In my opinion, one of ordinary skill in the art would readily understand "removably coupled" to mean that two structures are attached together in a manner that allows them to be detached from each other. In my opinion, no construction of "removably coupled" is required. If any clarification is required, then the entire phrase "heat exchanging interface being removably coupled to the reservoir" in claim 17 of the '362 patent, and the entire phrase "heat exchanging interface is removably coupled to the intermediate member" in claim 16 of the '681 patent, should be construed to give the term "removable coupled" some context. One of the ordinary skill in the art would understand the entirety of the phrases quoted above to mean that the "heat exchanging interface" is attached to the rest of the "reservoir" or the "intermediate member" in a manner that allows it to be detached.

26. It would be clear to one of ordinary skill in the art from the disclosures of the '362 and the '681 patents that a removable "heat exchanging interface" provides manufacturing benefits and flexibility, allowing for factory-floor swap outs of cold plates tailored to different CPU's (or GPU's) characteristics. *See, e.g.,* the '362 patent, col. 17, ll. 43-46; the '681 patent, col. 20, ll. 39-54. Both patents further disclose that the removable "heat exchanging interface" allows the reservoir to be made of plastic, while the cold plate itself can be made of a heat conductive metal, such as copper or aluminum. *See, e.g.,* the '362 patent at col. 4, ll. 4:52-66, col. 5, ll. 35-43. This provides cost savings, because copper and other appropriate heat-conductive material are much more expensive than plastic, and also provides manufacturing flexibility and factory-floor swap outs of cold plates, as noted above. In contrast, if the "heat exchanging interface" is irremovably coupled to the "reservoir" or the "intermediate member," i.e., the "reservoir" and the "heat exchanging interface"

are a one-piece structure, then the entire "reservoir" component would have to be constructed of heat-conductive metal. This would drastically increase the manufacturing costs of the claimed cooling system, and would not provide the manufacturing flexibility of the claimed removable "heat exchanging interface." Moreover, if the cold plate were irremovably attached/coupled to the "reservoir" or the "intermediate member," then the entire "reservoir" component (and not just the "heat exchanging interface" would have to be replaced whenever there was any change in the configuration of the processing unit that the cooling system is designed to be used with. This would also increase manufacturing and/or refurbishing costs of the claimed cooling system. The claimed invention, in contrast, allows cost effective changes to just the cold plate itself (rather than the entire reservoir).

27. The removable "heat exchanging interface" limitation does not imply that a user must be able to remove it with readily available tools, or that the unit must continue functioning after removal of the cold plate by a user, as was argued by defendant CMI USA in the Asetek Danmark A/S v. CMI USA, Inc. case. As I testified previously, the removable "heat exchanging interface" confers a manufacturing benefit; it is not intended to be a benefit for the user of the claimed liquid cooling system. A manufacturer will have the correct tool readily available to remove the "heat exchanging interface" if and when necessary. The "heat exchanging interface" is not intended to be removed by a customer.

C. "intermediate member"

Based on the disclosures of the '764 and '681 patent specifications and claims, a person of ordinary skill in the art would have understood "intermediate member" to mean a "structure between impeller cover and heat exchange/heat-exchanging interface." Figures 17 and 20 of both patents (and associated text) clearly illustrate an intermediate member 47 that is provided between pump chamber 46 and a heat exchanging interface 4. *See, e.g.,* the '764 patent, col. 22, ll. 26-59; the '681 patent, col. 22, l. 64—col. 23, l. 26. Specifically, intermediate member 47 is provided between impeller cover 46A (which defines pump chamber 46) and heat exchange interface 4. *See* Figure 20 of the '764 and the '681 patents. Intermediate member 47 and heat exchange interface 4 together define

thermal exchange chamber 47A. Intermediate member 47 includes a passage 48 that directs cooling liquid from pump chamber 46 to thermal exchange chamber 48. *See id.*

VII. TERMS OF THE COOLIT PATENTS

A. "header"/"manifold"

28. A person of ordinary skill in the art would have used and understood the terms "header" and "manifold" interchangeably to mean "a region into which several smaller channels lead" (in the context of an <u>outlet</u> header/manifold) or "a region from which several smaller channels lead" (in the context of an <u>inlet</u> header/manifold), both as a general matter and in the context of the CoolIT patents.

29. All four CoolIT patents support this definition of "header"/"manifold." For example, the CoolIT patents describe that one or more inlet openings 114, which have smaller cross-sectional area than header 112, communicate cooling fluid from header 112 into microchannels 103. *See, e.g.*, '330 patent, col. 3, l. 66—col. 4., l. 16, Fig. 1. Similarly, the CoolIT patents describe two or more outlet openings 124 that communicate cooling fluid to an outlet header 126 from microchannels 103. *See id.* at col. 5, ll. 1-8, Fig. 1.

30. CoolIT's '567 and '266 patents additionally describe an inlet manifold 13 and an exhaust manifold 15 that perform the same function as inlet header 112 and outlet header 126 (in the embodiment shown in Figure 2 of those patents). CoolIT's '567 and '266 patents further describe an inlet manifold 336 and two exhaust manifolds 337 that perform the same function as inlet manifold 13 and outlet manifold 15. The '567 and '266 patents describe that inlet manifold 336 distributes cooling fluid among a plurality of microchannels in heat sink 330, i.e., a plurality of small channels lead from inlet manifold 336. *See* '567 patent, col. 13, ll. 59-col. 14, l. 2, and Fig. 10. Similarly, the '567 and '266 patents describe that exhaust manifolds 337 collect the outward directed flow of cooling liquid from the microchannels. *Id.* at col. 16, ll. 10-21.

31. I disagree with CoolIT's proposed constructions of "header" and "manifold." One of ordinary skill in the art would not understand "header"/"manifold" to simply mean a region/space into which or from which liquid flows. In fact, CoolIT's proposed definitions confuse the meaning of "header"/"manifold" with the term "plenum," as that term is used in CoolIT's '567 and '266

patents. "Header"/"manifold" is a region into which or from which smaller channels distribute liquid. The "header"/"manifold" creates a constant pressure volume and helps to control the flow of fluid in the channels.

B. "plenum"

32. The term "plenum" is generally used in the context of buildings, where it defines a space used for cable routing in electrical systems, or air ducting in Heating Ventilation and Air Conditioning (HVAC) systems. It is not a commonly used term in the field of fluid mechanics and thermal management. Therefore, the term "plenum" should be construed in the context of CoolIT's ’567 and ’266 patents. Based on the disclosures of the ’567 and the ’266 patents and how they would be understood by one of ordinary skill in the art, the term "plenum" should be construed to mean a "region for fluid collection before entering an inlet manifold region or after exiting an exhaust manifold region." *See* ’567 patent, col. 13, ll. 29-34, col. 16, ll. 10-20, Fig. 10; ’266 patent, col. 13, ll. 55-60, col. 16, ll. 29-34, 52-56. In Figure 10 of both patents, inlet plenum 335 is shown as a region where cooling liquid collects prior to entering the inlet manifold 336. Similarly, Figure 10 shows that outlet plenum 338 as region where cooling liquid collects after exiting exhaust manifold 337. Indeed, the specifications of both these patents state that the inlet and outlet plenums "correspond" to the inlet and exhaust manifolds, respectively. *See* ’567 patent, col. 13, ll. 29-34; ’266 patent, col. 13, ll. 55-60.

33. CoolIT's definition of "plenum" disregards that cooling liquid flows from the inlet "plenum" into an inlet manifold/header or that liquid flows into the outlet "plenum" from the outlet header/manifold region, as described by the ’567 and ’266 patents. By doing so, CoolIT is attempting to blur the lines between the proper meanings of "header"/"manifold" and "plenum," as discussed above.

C. "seal"

34. Based on the disclosures of the ’330, ’284, and ’266 patents, one of ordinary skill in the art would understand that a "seal" is provided between the "plate" and the "housing" of the claimed fluid heat exchanger to prevent short-circuiting of cooling liquid from the inlet passage to the outlet passage through any space between the "plate" and the "housing," and thereby to force the

cooling liquid to flow through the microchannels on the heat-spreader plate. One of ordinary skill in the art would understand that fluid bypass can be prevented by fitting the "housing" and the "plate" in such a way that fluid cannot flow out between them. Therefore, I agree with Asetek's construction of "seal extending between the housing and the plate" as "the housing and the plate are fitted so that fluid cannot flow out from between them."

35. CoolIT's proposed construction, which requires the "seal" to be a "<u>component</u> that fills a gap to prevent leakage thorough the gap" (emphasis added) is overly limiting, in my opinion, because the "seal" does not necessarily have to a "component" placed between the "housing" and the "plate." Instead, there are multiple ways of fitting the "housing" and the "plate" in order to create a "seal" between them, for example, by compression fitting the surfaces of the "housing" and the "plate," which were known and readily understood by one of ordinary skill in the art.

D. "[inlet/outlet] flow path"

36. Based on the disclosure of the '284 patent, one of ordinary skill in the art would understand the terms "inlet flow path" and "outlet flow path" in claims 1 and 15 to mean the "portions of the microchannels not covered by the plate and where fluid enters or exits the microchannels." Specifically, based on the disclosure of the '284 patent, one of ordinary skill would understand "inlet flow path" to mean the opening 114 formed by the elongate cutout in the plate through which cooling liquid enters the microchannels. *See* '284 patent, Fig. 1. Similarly, one of ordinary skill would understand "outlet flow path" to mean the scalloped-shaped cutouts 124 through which cooling liquid exits the microchannels. *See id.* Indeed, it is the scalloped-shaped cutouts on the plate that provide "outlet flow paths" of different lengths—with the "outlet flow path" from a central microchannel being longer than the "outlet flow path" from the outermost microchannels, as recited in claims 1 and 15. For example, if the cutouts 124 on the plate were rectangular (instead of being scalloped), then the "outlet flow paths" would have the same length; the claimed "outlet flow paths" of different lengths would not be formed.

37. It is my understanding that in CoolIT's infringement contentions against Asetek's products, CoolIT has interpreted the term "outlet flow path" in claims 1 and 15 of the '284 patent to mean the mass flow of cooling liquid along the outlet header. Neither the patent specification, nor

the general knowledge of one of ordinary skill in the field of computer liquid cooling, supports such an interpretation of “outlet flow path.” If CoolIT’s proposed definition of “inlet/outlet flow path”—“an inlet/outlet path through which the liquid flows”—is adopted, then the metes and bounds of claims 1 and 15 become unclear. In particular, CoolIT’s definition does not provide the beginning and the end of the “outlet flow path,” so one of ordinary skill in the art would not be able to understand with reasonable certainty the meaning and scope of claims 1 and 15, which recite “outlet flow paths” of different lengths. Claims 1 and 15 also require multiple outlet flow paths corresponding to each microchannel, which cannot be achieved if “outlet flow path” is interpreted broadly to mean the flow of cooling liquid along the outlet header in Asetek’s products, as CoolIT proposes.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 7th day of November, 2019.

Dated: November 7, 2019

Donald E. Tilton

Exhibit
A

DONALD E. TILTON, PHD., CEM +1 671 682 1470
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Colton, Washington 99113 don.tilton@redhorsecorp.com

BIOGRAPHY

Experienced entrepreneur and executive leader with 25 years of experience founding, growing and leading companies. Managed growth from startup to over $40M, successfully navigating the business through several up/down cycles, changes in structure, organization, and strategy. Resourceful, innovative, and fiscally conservative management style. Passionate about transforming technology into lasting value.

- Innovative and inventive
- Strong, diverse technical leadership
- Leadership through service
- Customer/Value focused
- Profitability and rapid growth
- Integrate novel technology/business strategy
- Grant/contract & VC financed growth models
- Efficient use of capital/equity

CAREER EXPERIENCE

REDHORSE CORPORATION, (www.redhorsecorp.com) **11/18-Present**
Resource Efficiency Manager
Assigned to Joint Region Marianas, Guam. Assist in the identification and execution of Energy Efficiency and Renewable Energy Projects in support of Installation Energy Managers at Andersen Air Force Base and Naval Base Guam. Conducted solar system failure analysis and created improved design review process and training for both electrical and structural wind loading design. Supported Investment Grade Audit for AAFB Energy Savings Performance Contract effort. Assisted with Energy Mission Integration Group process to identify ~ $45M in future smart grid and energy resiliency projects.

PACIFIC RENEWABLE ENERGY SOLUTIONS, (www.presguam.com) **07/18-11/18**
Project Manager
Joined PRES to manage a 400kW commercial solar installation for a USDA grant. Also assisted in the development of other commercial and residential solar installation projects.

MINDSHARE RESOURCE SOLUTIONS, LLC, (www.consultmindshare.com) Spokane, WA**.** **2007-Present**
Managing Director, Emerging Ventures
Joined Mindshare to assist in the formation and growth of new technology businesses. Specialize in assisting clients with acquisition of non-dilutive capital through grants and contracts, strategy formation, proposal writing, etc. Sometimes serve interim executive rolls for clients, such as Grassroots Energy, Infinia, 3D4U, Ecowell, University Funds, Green IT Alliance, etc. (See below). For the past 6 years, focus has been on developing remote power systems and implementing micro-grid systems in the developing world, including installations in Bangladesh and India for villages without power.

GRASSROOTS ENERGY, (www.grassrootsenergy.co) **2013-Present**
Chief Technology Officer
Joined Grassroots Energy (and formerly, Emergence Bioenergy) on a consulting basis to identify the appropriate technology solutions for hybrid solar/biogas and biomass to electricity generation for establishing micro-grids in Rural Bangladesh and Northern India (mostly Bihar). Primarily responsible for the full system architecture for power generation, and novel applications for waste heat utilization. Assisted on the ground to implement solutions, train local personnel, and oversee and assess technical and economic aspects of operations.

DONALD E. TILTON

3D-4U, INC., (www.3D-4U.com) (Now VokeVR, www.vokevr.com) Pullman, WA. **November, 2013 – June, 2014**
VP, Operations
Engaged with 3D-4U, Inc., a Mindshare client, to develop manufacturing operations, assist in raising equity financing, and manage legal and finance functions in the business. Previous part time engagement, consulting to the Board of Directors to assist in restructuring of the business, raising equity investment, and completing a merger with Integrated Virtual Prototyping, Inc. Company was reorganized into Voke, VR, and sold to Intel Corp.

INFINIA CORPORATION, (www.infiniacorp.com) Ogden, UT. **November, 2011 – October, 2013**
Managing, Remote Power
Two-year engagement with Infinia, a Mindshare client, to assist in the formation of the Remote Power business unit. Oversaw the remote power product development effort, leading to the development and installation of Stirling biogas generators for Village Power applications in Bangladesh. Company was sold to Qnergy.

ECOWELL, INC., (www.drinkecowell.com) Pullman, WA **March, 2009 – 2011**
Founder, President, Chairman of the Board
Founded Ecowell, with 3 students from Washington State University that won the WSU Business Plan Competition in 2009. In a very short time, led the team to develop a revolutionary new beverage vending concept and deploy 10 kiosks in revenue generating sites as part of a test market program. Closed $4M equity financing to enable building production machines and begin market deployment.

WASHINGTON STATE UNIVERSITY, Pullman, WA **January, 2008 to May, 2011**
Adjunct Professor, Technology Ventures Course
Developed the curriculum and taught Technology Entrepreneurship to senior and graduate level engineering students as part of the Kauffman Foundation Award Winning, Harold Frank Engineering Entrepreneurship Program. Students from the class consistently won prize money in the WSU Business Plan Competition, and a few start-up companies have come out of the class.

THE UNIVERSITY FUNDS, LLC, Bellevue, WA **2009**
Vice-President of R&D
Assisted with the formation of The University Funds, LLC, focused on developing a new model for commercializing University derived intellectual property. Helped develop relationships with partner Universities and National Labs. Chair of the Science Committee in charge of reviewing University IP and assessing potential commercial value.

GREEN IT ALLIANCE, Pullman, WA **2008-2011**
Founder, Executive Director
Founded the Green IT Alliance, a non-profit 501c3 to conduct research and education around IT energy efficiency at the enterprise level. IT power consumption represents as much as 40% of the power consumption in a modern enterprise, yet there is very little attention on this issue. At the Green IT Alliance, innovative approaches to integrating IT energy efficiency with building architecture and design, such as solar powered server farms, ornamental ponds for liquid server cooling, and thin client architectures were explored and demonstrated. This initiative was part of the State of Washington Innovation Partnership Zone program. Also served as the Pullman IPZ Zone Administrator.

ISOTHERMAL SYSTEMS RESEARCH, INC., (SPRAYCOOL) Liberty Lake, WA **1988-2008**
Founder, President/CEO, Vice-Chairman of the Board
Founded Isothermal Systems Research, Inc. (sold to Parker Aerospace) in 1988 while attending graduate school at the University of Kentucky. Developed and deployed critical technologies for Intelligence and National Defense, and as President/CEO grew the company profitably with little outside funding to a peak of $43 Million in Revenue. During the 20-year tenure, the primary focus was leveraging government contracting expertise to grow the business. Developed a broad set of business, marketing, management, strategy and technology skills.

SELECTED PROFESSIONAL/VOLUNTEER ACTIVITIES

WSU BUSINESS PLAN COMPETITION **2008-2012**
Judge/Team Mentor
Serve as a mentor to 3 or 4 undergraduate and MBA teams every year, and participate as a competition judge.

NCIIA INVENTION TO VENTURE **2010-2011**
Seminar Organizer/Presenter
With the Harold Frank Program, helped organize and execute an Invention to Venture workshop in Pullman, WA in 2010 and the 2011 2011 workshop for Spokane with additional sponsors Gonzaga Hogan Entrepreneurship Program and SIRTI. Arranged speakers, finalized presentations and moderated the events.

NORTHWEST VENTURE FORUM **2010**
Panel Speaker/Presenter
Served as a speaker and panelist at the 2010 Northwest Venture Forum in Spokane. Covered topics regarding venture investing from the perspective of the Entrepreneur.

PALOUSE DISCOVERY SCIENCE CENTER **2008-2011**
Board of Directors
Serve on the Board and the Finance Advisory Committee of a local science center. Perform general advisory and governance role and helped create funding for exciting new educational programs with an outdoor environmental education, interpretive walk.

THE GREEN GRID, (www.thegreengrid.org) **2007-2008**
Board of Directors
Played a key role in the early formation and building of The Green Grid, an organization dedicated to solving key issues around Data Center power consumption. As Chair of the Liaison Committee, worked to form relationships with other key industry organizations, such as DMTF, ASHRAE, SNIA, etc., and Government Agencies such as DOE/EERE and the EPA Energy Star program offices. Also helped with the formation of The Green Grid Japan, and setting up liaison relationships with Japanese IT companies, industry organizations and government agencies.

WASHINGTON STATE UNIVERSITY RESEARCH FOUNDATION **1993-1998**
Board of Directors
Served a five-year term on the Board of the WSU Research foundation which oversees technology transfer and operates a business incubator. Gave lectures on challenges associated with commercializing University IP, representing the business perspective.

EDUCATION

Washington State University, Pullman, Washington
December, 1985; BS in Mechanical Engineering

University of Kentucky, Lexington, Kentucky
May 1987; MS in Mechanical Engineering
December, 1989, PhD in Mechanical Engineering

Mathile Institute, Executive Education Series
Strategic Planning, 2001

PATENTS/TECHNICAL SKILLS

Prolific innovator and inventor with 25 issued patents, and many more pending. Very good understanding of intellectual property law, patent defense, IP Strategy, and economically driven technology development and protection. Served as Expert Witness in successful Patent Litigation law suit. Strong technical skills in interdisciplinary engineering, energy efficiency, renewable energy, thermal management systems, heat transfer, fluid flow, and the application to complex systems.

1	US13/798,296	Containerless-custom beverage vending invention
2	7,788,939	Azeotrope spray cooling system
3	7,602,608	Narrow gap spray cooling in a globally cooled enclosure
4	7,495,914	Narrow gap spray cooling in a globally cooled enclosure
5	7,469,551	Globally cooled computer system
6	7,428,152	Localized thermal management system
7	7,372,698	Electronics equipment heat exchanger system
8	7,313,925	Atomizer for thermal management system
9	7,301,772	Three dimensional packaging and cooling of mixed signal, mixed power density electronic modules
10	7,299,647	Spray cooling system for transverse thin-film evaporative spray cooling
11	7,086,455	Spray cooling system
12	7,078,803	Integrated circuit heat dissipation system
13	7,044,768	Liquid thermal management socket system
14	7,009,842	Three dimensional packaging and cooling of mixed signal, mixed power density electronic modules
15	6,955,062	Spray cooling system for transverse thin-film evaporative spray cooling
16	6,952,346	Etched open microchannel spray cooling
17	6,889,515	Spray cooling system
18	6,108,201	Fluid control apparatus and method for spray cooling
19	6,016,969	Laminated array of pressure swirl atomizers
20	5,880,931	Spray cooled circuit card cage
21	5,860,602	Laminated array of pressure swirl atomizers
22	5,719,444	Packaging and cooling system for power semi-conductor
23	5,713,327	Liquid fuel injection device with pressure-swirl atomizers
24	5,314,529	Entrained droplet separator
25	5,220,804	High heat flux evaporative spray cooling